Using (4) to solve successively (1), (5), and (2) we obtain

$$Y_b=-3W, \quad X_b=(W+Y_b)\tan 18^\circ=-2W\tan 18^\circ,$$
$$X_a=2W\tan 18^\circ-5W\cot 54^\circ.$$

Putting these values into (3) and dividing by $2W$ we get

$$(6) \qquad -2\tan 18^\circ.n.\cos 54^\circ-3W.n\sin 54^\circ+(m-n)\sin 54^\circ$$
$$+(5\cot 54^\circ-2\tan 18^\circ).m\cos 54^\circ=0.$$

Multiplying (6) by $\sin 54^\circ$, collecting m and n, and later employing the identities $2\sin^2 x=1-\cos 2x$, $2\cos^2 x=1+\cos 2x$, and $2\sin x\cos x=\sin 2x$, we obtain:

$$m[\sin^2 54^\circ-2\sin 54^\circ\cos 54^\circ\tan 18^\circ+5\cos^2 54^\circ]$$
$$=n[4\sin^2 54^\circ+2\sin 54^\circ\cos 54^\circ\tan 18^\circ],$$
$$m[3+2\cos 108^\circ-\sin 108^\circ\tan 18^\circ]=n[2-2\cos 108^\circ+\sin 108^\circ\tan 18^\circ],$$
$$\text{or, } m[3-3\sin 18^\circ]=n[2+3\sin 18^\circ],$$
$$\text{whence, } \quad m : n=2+3\sin(\pi/10) : 3-3\sin(\pi/10).$$

The proposed result follows immediately from this one, if we recall from geometry that the half-side of the regular inscribed decagon $=R(\sqrt{5}-1)/4$, so that $\sin 18^\circ$ satisfies the equation

$$(4\sin x+1)^2=5 \text{ or } 4\sin^2 x+2\sin x=1.$$

For from this we obtain $\sin x(3\sin x+2)=1-\sin^2 x$, or $2+3\sin x : 3(1-\sin x) :: 1+\sin x : 3\sin x$.

PROBLEMS FOR SOLUTION.

ALGEBRA.

343. Proposed by THEODORE L. DeLAND, Treasury Department, Washington, D. C.

A, on contracting to execute a piece of work for $300 and finding after working alone one day that he had finished but 1% of the entire work, engaged B to assist him at the beginning of the second day, with the understanding, that B on each day was to do 6% as much work as had been completed previously, while A each day was to do an amount of

work equal to 1% of the unfinished work at the close of the day before. At the completion of all the work the $300 were divided between A and B in proportion to the amount of the work each had performed.

Required—(1) The number of days to do the work; (2) on which day would the daily earnings of A and B be the same; and (3) the amount of money each was paid under the agreement.

344. Proposed by V. M. SPUNAR, Cleveland, Ohio.

Given $x^7-5x^2y^4=-1506...(1)$, and $y^5-3xy=103...(2)$; find the values of x and y.

GEOMETRY.

374. Proposed by PROF. R. C. ARCHIBALD, Brown University.

The locus of the middle points of chords, of a conic, which all pass through a fixed point P, is a conic. In general, four chords equal to a given length K can be drawn through P. Show that the middle points of these equal chords lie on a circle whose center is independent of K.

375. Proposed by C. N. SCHMALL, New York City.

From a point P on a circle there are drawn three chords PA, PB, PC. Show that the circles described on these chords as diameters intersect again in three collinear points.

376. Proposed by S. LEFSEHETZ, East Pittsburg, Pa.

Inscribe in a given circle a quadrilateral, having given the three diagonals.

CALCULUS.

300. Proposed by E. B. ESCOTT, University of Michigan, Ann Arbor, Mich.

Solve the differential equation obtaining the complete primitive:
$(x^2+x^2y+2xy-y^2-y^3)dx+(y^2+xy^2+2xy-x-x^3)dy=0.$

301. Proposed by C. N. SCHMALL, New York City.

Show that the volume of the surface,
$\left(\frac{x}{a}\right)^{\frac{2}{3}}+\left(\frac{y}{b}\right)^{\frac{2}{3}}+\left(\frac{z}{c}\right)^{\frac{2}{3}}=1$, is $\frac{100\,\pi\,abc}{3.7.11.13}$.

BOOKS AND PERIODICALS.

College Algebra. By Schuyler C. Davidson, Sc. D., Professor of Mathematics in Indiana University. 8vo. Cloth sides and leather back, xiv+243 pp. Price, $1.50 net. New York: The Macmillan Co.

This book, we are told in the preface, is not written for the mathematician but for students wishing to know the elements of ordinary algebra. For this reason, the book is